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A Study of Functional Outcome of Proximal Femur Fractures Managed by Proximal Femoral Nailing

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Abstract: ***Introduction**: Extracapsular proximal femur fractures include trochanteric and subtrochanteric fractures are seen in both young, adults and elderly population following trauma or pathological cause. With trial and evolution of different types of implants for surgical management, it was found that intramedullary implants were best suited for unstable. This study aims to evaluate functional and radiological outcome of extracapsular proximal femur fractures managed by proximal femur nail. **Objectives**: To analyze the functional radiological outcome of unstable proximal femur fractures managed with proximal femur nailing by modified Harris hip score and by pre - operative, intra - operative, post - operative serial radiographs. **Methods**: This prospective study includes 40 patients with unstable extracapsular femur fractures treated with proximal femur nail. The functional outcome of fixation is assessed using modified Harris hip score for a duration of 6 months and the radiological outcome is assessed using serial radiographs. **Results**: In this study the mean modified Harris hip score at 3 months is 80.55 and at 6 months is 85.35 which is GOOD functional outcome according to the scoring system used. Only 1.25% patients had poor outcome. The average time of union observed is 21.57 weeks. **Conclusions**: From this study, we consider that proximal femoral nail as a reliable implant for the treatment of unstable extracapsular proximal femur fractures. This implant also gives good functional outcome in intertrochanteric and subtrochanteric fractures. Even though the learning curve of this procedure is steep with proper patient selection, good instruments, image intensifier and surgical technique, PFN remains the implant of choice in the management of extracapsular proximal femur fractures. Patients treated with PFN are typically allowed early mobilization and weight - bearing, leading to a decrease in complications such as bedsores, uremia, and hypostatic pneumonia.*

Keywords: Unstable extracapsular proximal femur fractures; proximal femur nail; functional outcome; radiological outcome; modified Harris hip score.

1. Introduction

Proximal femoral fractures, which predominantly affect individuals aged 50 and older, constitute a major component of trauma - related hospital admissions with a prevalence exceeding 90%. The incidence of such fractures is notably higher in women—approximately two to three times greater than in men. These fractures can be classified anatomically into three categories: femoral neck, intertrochanteric, and subtrochanteric fractures, each presenting distinct challenges in terms of treatment and associated complications.

Among the proximal femoral fractures, those occurring in the trochanteric region, including pertrochanteric and intertrochanteric fractures, have been challenging to manage. However, the choice of the most appropriate implant for subtrochanteric fractures remains a topic of discussion, with various intra - and extramedullary devices being considered.

The biomechanics of extracapsular fractures, which involve cortical and cancellous bone, are complex due to the varying bone structure and stress patterns in the proximal femur. These fractures typically follow the path of least resistance through this area.

Introduced in 1997, the proximal femoral nail (PFN) was developed to mitigate implant - related complications and offer a surgical remedy for these complex fractures. The choice between operative and non - operative treatments has evolved significantly, with the latter now reserved primarily for patients with severe comorbidities or limited life expectancy.

The dynamic hip screw (DHS), once standard for stabilizing intertrochanteric fractures, has often proven inadequate, particularly in unstable cases. In contrast, intramedullary devices like the PFN provide superior biomechanical stability, facilitate early mobilization, and reduce surgical impact by preserving the fracture hematoma and minimizing blood loss.

These shortcomings can be overcome by intramedullary devices such as proximal femoral nail (PFN), which yields better rigidity and biomechanically more stable fixation. Intramedullary device also helps in early mobilization, preserves fracture hematoma, lesser blood loss, shorter durations of surgery and early union at fracture site.

Thus, the purpose of our study is to analyze the functional as well as radiological outcome of unstable extracapsular proximal femur fractures fixed with proximal femur nail (PFN).

2. Aim and Objectives

Aim

To evaluate clinical and radiological outcome of unstable extracapsular proximal femur fracture when treated with proximal femur nailing.

Objectives:

1) To analyse the functional outcome of unstable proximal femur fractures managed with proximal femur nailing by modified Harris hip score.
2) To analyse the radiological outcome of proximal femur fractures managed with proximal femur nailing by pre - operative, intra - operative, post - operative serial radiographs.

3. Methodology

Subjects And Methods

Study Area:

- The study will be carried out in the Department of Orthopaedics, Saraswathi Institute of Medical Sciences, Hapur (U. P).

Study Population:

- All patients between the age group 15 to 75 years presenting with unstable proximal femur fracture.

Study Design

- Observational study

Type Of Study:

- Prospective study

Study Duration:

- 2 years (July 2022 to June 2024)

Sample Size:

- 40 cases

Sample Selection:

Inclusion Criteria:

- All unstable intertrochanteric fracture classified by OTA/AO classification (Type 31A2.1 to 31A3)"
- All unstable subtrochanteric fractures classified by OTA/AO classification (Type 32. A3.1, 32. A3.2 and 32. A3.3)
- Patients aged 15 years to 75 years of all gender admitted at SIMS with proximal femur extra capsular fracture.

Exclusion Criteria:

- Open femoral fractures
- Bilateral fractures
- Mal - united or non - united femur fractures
- Intra - articular femoral fractures
- Pathological femoral fractures
- Neurological and psychiatric disorders that preclude reliable assessment
- Patients who were on prolonged steroid therapy

Calculation of Sample Size

The Sample size for the study will be calculated By using formula as below:

$$n = \left(s_1^2 + s_2^2\right) * \frac{\left(Z_{\alpha/2} + Z_{1-\beta}\right)^2}{\left(\mu_1 - \mu_2\right)^2}$$

Where;

n = sample size

s_1 =1.4

s_2 =1.5

$Z_{\alpha/2}$ =1.96 at 5% level of significance

$Z_{1-\beta}$ =0.84 at 80% power of test.

$\boldsymbol{\mu_1 - \mu_2}$=1

Therefore,

n = 12.6

So, the approximate sample size of this study is 40 patients.

4. Results

The average age of participants in this study on extracapsular proximal femur fracture is approximately 50 years, with the majority being in the 61 - 75 - and 31 - 40 - year age groups.

Males constituted 65% of the cases in our study, suggesting a higher prevalence of extracapsular proximal femur fractures among men.

The most common mode of injury was self - fall, accounting for 57.5% of cases, which is typically seen in the elderly.

40% of the fractures were left - sided intertrochanteric fractures.

According to the OTA classification, the most common injuries were type 31. A2.1 (intertrochanteric fracture with one intermediate fragment), reflecting the predominance of unstable fractures.

In terms of injury side, the left side was more commonly affected, with 62.5% of cases.

The mean interval between injury and surgery was 4.5 days, with surgeries typically performed within a week of injury.

The average duration of surgery was approximately 79 minutes, with most surgeries lasting between 76 and 90 minutes.

The average follow - up period was 7.5 months, ranging from 6 to 13 months.

Fracture union was most commonly observed at 24 weeks, with an average time to union of approximately 21.5 weeks.

The modified Harris hip score indicated that 47.5% of patients achieved a good functional outcome by 6 months, while 27.5% had a fair outcome.

The mean modified Harris hip score improved from 80.55 at 3 months to 85.35 at 6 months, indicating overall good functional outcomes.

5. Discussion

In case of unstable proximal femur fractures, a successful treatment relies on several variables including the patient's age, overall health, time elapsed from fracture to treatment, the quality of treatment administered, any concurrent medical conditions, and the stability of fixation. Common causes of treatment failure include disregarding biomechanics,

overestimating the efficacy of new surgical techniques or implants, and inadequate adherence to established protocols. Presently, there is a prevailing belief that all unstable proximal femur fractures should undergo internal fixation to mitigate patient morbidity and mortality. However, there remains ongoing debate regarding the most appropriate method and optimal implant for fixing these fractures, as each approach carries its own set of advantages and disadvantages. Following are the observations in our study.

The mean age of our study cohort is 49.97 years, consistent with other studies. This demographic alignment enhances the generalizability of our findings and facilitates comparisons.

Gender preponderance was almost similar to other studies. This result can be substantiated by the frequency of fractures more among young adults of working age.

Around 42.5% of the study participants had a road traffic accident and 47.5% had self - fall. In younger population, RTA was more common mode of injury and self - fall from ground level was more common in elderly patients. The mode of injury was comparable with other study results.

There was left sided fracture predominance among the study participants. The side of injury is a variable component of study.

The mean duration of surgery in our study was 78.75 minutes which is less as compared to previous study. With passage of time, instrumentation, operative techniques and learning, the duration of surgery has been reduced.

Fracture union was confirmed by callus formation over cortical ends of fracture on serial radiographs. In our study the mean duration of union was 21.5 weeks which is similar to results found in previous studies.

The functional outcome of extracapsular proximal femur fractures was comparable to other study results by the Modified Harris Hip Score when managed by Proximal Femur Nail (PFN). Most of the patients had GOOD functional outcome similar to previous studies

The Modified Harris Hip Score has a high correlation with the standard Harris Hip Score and can be used as a reliable and valid tool for assessment of functional outcome after total hip replacement in Indians. This tool may be used for future functional outcome evaluations as a single index.

6. Conclusion

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